

Functional Diversity of Prokaryotes (C003307)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size (nominal values; actual values may depend on programme)
Credits 4.0 Study time 120 h Contact hrs 27.5 h

Course offerings and teaching methods in academic year 2020-2021

Deze cursus is 2-jaarlijks en wordt niet aangeboden

Lecturers in academic year 2020-2021

Willems, Anne	WE10	lecturer-in-charge
Vandamme, Peter	WE10	co-lecturer

Offered in the following programmes in 2020-2021

	crdts	offering
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Teaching languages

English

Keywords

Bacterial metabolism, occurrence, lifestyle, chemolithotrophy, fermentation, symbiosis, extremophiles

Position of the course

This elective course aims to give a thorough understanding of the metabolic diversity of prokaryotes as the basis of their functional versatility and of their occurrence and role in habitats. After a short introduction to the conventions on naming and recognizing bacteria, we will discuss the different ways of life that bacteria and archaea have evolved to cope with nearly all the very diverse conditions found on our planet.

Contents

Introductory brief review of tools to study bacterial diversity:

- Overview of the challenges
- Naming and classification system
- Overview of the techniques

Overview of the main phyla of Bacteria and Archaea

Different ways of life: metabolic diversity of prokaryotes to survive in almost any situation

- The aerobic way of life: Focus on the role of oxygen as ultimate means of decomposing special substrates (complex carbon compounds, methylotrophy, methanotrophy).
- The phototrophic way of life: is only mentioned briefly to complete the overview – different aspects are treated in detail in Functional Abiotic Interactions and Microbial Ecology
- Chemolithotrophy: energy from oxidation of inorganic electron donors: Hydrogen oxidation, oxidation of reduced sulfur compounds, iron oxidation, nitrification and Anammox are discussed in detail.
- Anaerobic ways of life: anaerobic respirations: the concept anaerobic respiration vs. aerobic respiration at a molecular and biochemical level, Nitrate reduction and the process of denitrification, DNRA, sulfate reduction, acetogenesis, methanogenesis, iron, manganese, chlorate and organic electron acceptors.
- Anaerobic ways of life: fermentations: the concept of fermentation: energy and redox considerations, the fermentative diversity with examples of sugar fermentations by Enterobacteriaceae, clostridia and the lactic acid bacteria. Protein fermentation by clostridia.
- Symbiotic associations with eukaryotes: many eukaryotes host endosymbiotic prokaryotes (e.g. protists, sponges, various insects, algae, higher plants and animals) that they depend on for several, sometimes vital functions. We provide an overview of

the most important functions and a few detailed examples. Emphasis will be on the range of diverse systems rather than detailed functional mechanisms that will be seen in Functional Biotic Interactions

- Prokaryotic life in extreme conditions: some examples of champions in conditions of extreme temperature, pressure or toxicity

Overview of the role of bacteria and communities of bacteria in the cycles of the elements: the carbon cycle, nitrogen cycle, sulfur cycle, iron cycle.

Initial competences

The student has successfully completed the courses General Microbiology, Biochemistry I, and Biochemistry II from the bachelor Biology study program or has acquired the final competences of these courses in a different way.

Final competences

- 1 To describe the metabolic diversity of prokaryotes and the main mechanisms involved.
- 2 To explain the role of micro-organisms in the cycles of the main elements and their contribution to ecosystem functioning.
- 3 To indicate the main steps in the process of bacterial classification and describe the main groups of known bacteria.
- 4 To explain the ways of life, the occurrence and the diversity of the main functional groups of prokaryotes.
- 5 To hypothesize about the prokaryotic diversity that may be present in a particular habitat.
- 6 To explain the presence and function of particular groups of prokaryotes in a habitat.
- 7 To collect, integrate and critically evaluate new information together with related information from other disciplines.
- 8 To orally, using a slide presentation, summarize and present new information to other students (possibly in a second language).

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, microteaching

Learning materials and price

Presentations and pdf files of relevant scientific publications are available electronically. Brock Biology of Microorganisms, 15th edition 2019, Madigan, Bender, Buckley, Sattley & Stahl. Pearson Education Inc. ISBN 978-1-292-23510-3.
Estimated price: 70 EUR

References

Course content-related study coaching

Questions of students are discussed during or after the classes. In addition, the lecturer is available to answer individual questions and provide extra information or to discuss problems.

Via the electronic learning application, a forum discussion page is available on the course site where questions can be posed.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Open book examination

Examination methods in case of periodic evaluation during the second examination period

Open book examination

Examination methods in case of permanent evaluation

Assignment

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Non-periodic evaluation: evaluation of the presentation and contribution to oral discussion are taken into account (attendance is required)

Calculation of the examination mark

Periodical evaluation: 10/20

Non-periodical evaluation: 10/20. This is the evaluation of the assignment.

In the second exam period, the same marks for non-periodical evaluation are again taken into account for 10 out of the total of 20 points.